After simultaneous pumping and degassing of the mechanical pulp in the pump 13, the pulp is immediately passed to a mixer 28. The pulp must be passed to the mixer 28 so that substantially no air introduction occurs, and the mixer 28 must effect mixing without air introduction. At the mixer, hydrosulfite bleaching chemical is added from line 29 to the mixer, and is thoroughly mixed with the pulp. For the practice of the present invention, the mixer 28 preferably comprises a fluidizing mixer such as shown in U.S. Patents 4,093,506 and 4,339,206,

The amount of hydrosulfite bleaching chemical added to provide an effective charge will vary depending upon the properties of the mechanical pulp, the amount of bleaching desired, etc. Typically, however, the sodium hydrosulfite or zinc hydrosulfite would be added so that the total charge was about 0.5-1.5 percent. Buffering, sequestering, and/or chelating agents, such as sodium tripolyphophate and sodium diethylenetriaminepetaacetate, are also preferably added with the hydrosulfite.

After mixing of the hydrosulfite bleaching chemical into the pulp using mixer 28, the pulp, still at the same consistency (i.e. 5-25 percent), is retained at predetermined pH and temperature conditions for a predetermined period of time to effect the desired bleaching. This retention may be merely in conduits passing the pulp onto a further processing station, or may be in a vessel particularly designed for that purpose, such as a conventional up-flow bleaching tower 31. Typical, although not limiting, conditions are: pH, about 4.5-6.5; temperature, about 35-80 C; retention time, about 0.25-2 hours.

Typically, the mechanical pulp is produced utilizing any desired conventional technique, and then is fed by line 11 to a storage tower 12 or the like. According to the present invention it is preferable to mount a fluidizing centrifugal pump 13 at the bottom of the storage tower 12, to draw the mechanical pulp downwardly therefrom. The pulp typically has a consistency of about 5-25 percent, and a consistency of 8-15 percent is preferred.

The fluidizing centrifugal pump 13, and an apparatus and method for controlling the head therefrom, are illustrated and described in Applicant's United States Patent No. 4,435,193 issued March 6, 1984. The pump 13, as illustrated in Figure 2, may comprise an inlet channel 14, a rotor 15 including a plurality of axially extending blades 16 having an interior opening 17 therebetween, and impeller blades 18. The blades 18 rotate in a spiral housing section 19, and gas can pass through openings 21, 22 from the housing section 19 to a gas chamber 20, the gas chamber 20 being connected up to a gas discharge line 23.

Pulp passes from the pump 13 into the discharge line 25, with a throttling valve 26 disposed therein. The head of the pump 13 is controlled, by adjusting the throttling valve 26 in a manner explained in the aforementioned U.S. Patent No. 4,435,193, so that a variety of heads within a wide range may be achieved. The valve 26 preferably is controlled, according to the present invention, so that the pump head is maximized, to thereby maximize the degassing action of the pump (i.e. maximizing the amount of air withdrawn through conduit23).

Alternatively, the mixer may be eliminated, and the hydrosulfite added directly to the fluidizing pump. For instance, the chemical may be added to the discharge, or the suction, of the pump.

It is the primary object of the present invention to provide a method for treating mechanical pulp to provide efficient reductive bleaching thereof. This and other objects of the invention will become clear from an inspection of the detailed description of the invention and from the appended claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic view illustrating exemplary apparatus utilized in practicing the method according to the present invention;

FIGURE 2 is a schematic detail cross-sectional view of the exemplary fluidizing centrifugal pump illustrated in FIGURE 1; and

FIGURES 3 and 4 are schematic views of two different alternative embodiments of apparatus for practicing the method of the invention.

## DETAILED DESCRIPTION OF THE DRAWINGS

The method according to the present invention is applicable to mechanical pulps. That term, as commonly used in the industry and as used in the instant specification and claims, encompasses refiner mechanical pulps (RMP), chemimechanical pulps (CMP), thermomechanical pulps (TMP), chemithermomechanical pulps (CTMP), and stone groundwood pulps.

mechanical pulps having a consistency of much greater than 4 percent since as the consistency rises the pulp tends to entrain air. However, it is desirable to effect bleaching at the same consistency as for other processing of the pulp (e.g. 5-25 percent, preferably 8-15 percent), although successive diluting and thickening stages are to be avoided because of the equipment costs and energy expense associated therewith.

According to the present invention, a method of treating mechanical pulp is provided that allows reductive bleaching of the pulp in an effective manner at pulp consistencies of about 5-25 percent, and preferably 8-15 percent, during the entire treating procedure. According to one aspect of the present invention, the method comprises, or consists essentially of, the following sequential steps: (a) Simultaneous pumping and degassing the mechanical pulp. This is preferably accomplished utilizing a fluidizing centrifugal pump. (b) Immediately after after (a), mixing, substantially without air introduction, the mechanical pulp with an effective charge of hydrosulfite bleaching chemical. The mixing preferably is accomplished in a fluidizing mixer, and the hydrosulfite bleaching chemical includes sequestering, chelating, and buffering agents. A typical charge is 0.5-1.5 percent hydrosulfite. And (c) retaining the pulp at predetermined pH (e.g. about 4.5-6.5) and temperature (e.g. about 35-80°C) conditions for a predetermined period of time (e.g. about 0.25-2 hours) to effect the desired bleaching. By practicing the invention oxidation of the reductive bleaching agent is avoided, a minimal amount of equipment is utilized, and the processing can be done at the desired consistency range of 8-15 percent.

0155928

# MECHANICAL PULP PUMPING AND HYDROSULFITE BLEACHING

## BACKGROUND AND SUMMARY OF THE INVENTION

With shortages in raw materials for manufacture of paper pulps, mechanical pulping processes have become of more interest. Mechanical pulping processes generally have higher yields than chemical pulping processes. However, since in mechanical pulping processes (including refiner mechanical pulping (RMP), chemimechanical pulping (CMP), thermomechanical pulping (TMP), and chemithermomechanical pulping (CTMP)), most of the lignin and polysaccharides are left in the pulp, rather than being dissolved and modified as in chemical pulping, bleaching must be accomplished by decoloration, instead of by solubilization, as in chemical pulping.

One major process for bleaching of mechanical pulps is a reductive bleaching process utilizing hydrosulfite, such as sodium hydrosulfite or zinc hydrosulfite. While hydrosulfite bleaching can achieve the desired decoloration of the mechanical pulp, there are a number of drawbacks associated with its use. Hydrosulfite is oxidized extremely rapidly by air, therefore the entrainment of air in the pulp can negate the bleaching effects of the hydrosulfite. This makes hydrosulfite impractical for use with

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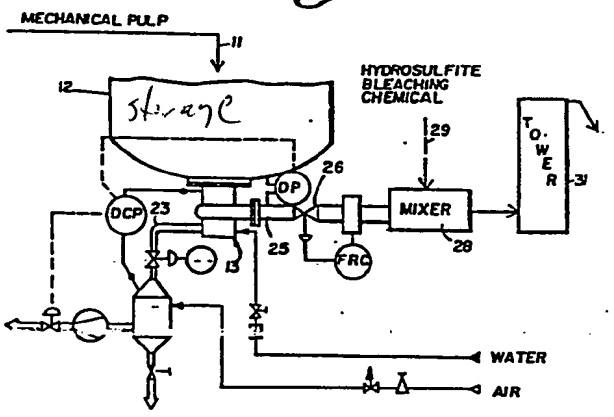
## (54) Mechanical pulp pumping and hydrosulfite bleaching.

(57) A medium consistency mechanical pulp (e.g. RMP, CMP, TMP, CTMP or stone groundwood) is treated to effect efficient reductive bleaching. The pulp, at about 8-15% consistency is simultaneously pumped and degassed utilizing a fluidizing pump (13), and by controlling the pump head to maximize deaeration. The pulp may be immediately passed -- without air introduction -- to a fluidizing mixer (28), where it is mixed with hydrosulfite (dithionite) bleaching chemical. Alternatively, the hydrosulfite may be added directly to the discharge (25) or suction (14) of the pump, and the mixer eliminated. After chemical addition, the pulp is retained at predetermined pH and temperature conditions for a predetermined period of time to effect the desired bleaching, as in an upflow tower (31).

Fig. 1

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Since the pulp is essentially completely degassed before mixing with the hydrosulfite bleaching chemical, the bleaching action can be effectively controlled, and the desired amount of bleaching chemical can be added to effect the desired bleaching. The degassing action is accomplished, according to the present invention, in a simple and effective manner, and with a minimum amount of equipment. The pulp, at a consistency of between 5-25 percent, and preferably 8-15 percent, is withdrawn from storage tower 12, simultaneously pumped and degassed by fluidizing centrifugal pump 13, the head of which is controlled by valve 26 to maximize degassing action, immediately passed to fluidizing mixer 28 at which the hydrosulfite bleaching chemical is added via line 29, and subsequently passed to a conventional retention tower 31, or the like, where it is retained at predetermined pH and temperature conditions for a predetermined period of time to effect desired bleaching.

In the exemplary embodiments of the present invention illustrated schematically in FIGURES 3 and 4, the mixer 28 is eliminated, and instead the hydrosulfite is added directly to the pulp within the pump 13. In the FIGURES 3 and 4 embodiments, the control mechanisms for the pump 13 have not been shown, for clarity of illustration.

In the FIGURE 3 embodiment, the hydrosulfite bleaching chemical is added through line 33 directly to the discharge of the pump 13. At the discharge of the pump 13, the pulp has been effectively degassed, and when the bleaching chemical is added through a nozzle, or like other introduction structure, due to the turbulence of the pulp at that point, it will

become intermixed with the pulp, and effective bleaching will occur.

In the embodiment illustrated in FIGURE 4, the pump 13 is shown with the axis of rotation of the rotor thereof horizontal. This merely illustrates that the present invention may be practiced irrespective of the orientation (e.g., horizontal or vertical) of the pump rotor.

In the FIGURE 4 embodiment, the hydrosulfite bleaching chemical is added via line 35 at the suction of the pump 13. Again, introduction can be accomplished utilizing a suitable nozzle, or the like. While the pulp is not completely degassed at this position, adding the bleaching chemical at the suction provides for complete intermixing of the bleaching chemical with the pulp as it is pumped by the pump 13, and the time from chemical addition at the suction side of the pump, to effective degassing by the pump, is short enough that under most circumstances entrained air will not significantly negate the bleaching effects of the hydrosulfite. However, if entrained air does negate such effects for a particular pulp, then the embodiments of FIGURES 1 and 3 will be utilized instead of the embodiment of FIGURE 4.

While the invention has been herein shown and described in what is presently conceived to be the most practical and preferred embodiment thereof, it will be apparent to those of ordinary skill in the art that many modifications may be made thereof within the scope of the invention, which scope is to be accorded the broadest interpretation of the appended claims so as to encompass all equivalent methods and procedures.

WHAT IS CLAIMED IS:

1. A method of treating a mechanical pulp with hydrosulfite bleaching chemical characterized by the steps of sequentially: (a) simultaneously pumping and degassing the mechanical pulp at a consistency of about 8-15%; (b) mixing, without substantial air introduction, the about 8-15% consistency mechanical pulp with an effective charge of hydrosulfite bleaching chemical; and (c) retaining the pulp at predetermined pH and temperature conditions for a predetermined period of time to effect desired bleaching thereof.

2. A method as recited in claim 1 further characterized in that the hydrosulfite bleaching chemical added in step (b) includes buffering, chelating, and sequestering agents, and step (b) is practiced by adding sufficient hydrosulfite bleaching chemical charge so that the hydrosulfite bleaching chemical comprises about 0.5-1.5 percent.

3. A method as recited in claim 2 further characterized in that step (c) is practiced by maintaining the pH at about 4.5-6.5, and maintaining the temperature at about 35-80°C, and wherein the predetermined time period is about 0.25-2 hours.

4. A method as recited in claim 1 further characterized in that step (a) is practiced utilizing a fluidizing pump, and by controlling the head of the pump by throttling the pulp output from the pump, so that substantially complete degassification of the pulp occurs.

5. A method as recited in claim 1 further characterized in that step (b) is practiced immediately after step (a); and step (a) is practiced utilizing a fluidizing pump, and step (b) is practiced utilizing a fluidizing mixer separate and distinct from the pump.

6. A method as recited in claim 5 further characterized in that step (c) is practiced by feeding the pulp to an up-flow bleaching tower after it passes through the fluidizing mixer.

7. A method as recited in claim 1 further characterized in that steps (a) and (b) are practiced utilizing a fluidizing pump, and the chemical is added to the discharge of the pump.

8. A method as recited in claim 1 further characterized in that steps (a) and (b) are practiced utilizing a fluidizing pump, and the chemical is added to the suction of the pump.

9. A method as recited in claim 1 further characterized in that the mechanical pulp is selected from the group consisting essentially of CTMP, TMP, CMP, and stone groundwood.

10. A method as recited in claim 5 further characterized in that the hydrosulfite bleaching chemical added in step (b) includes buffering, chelating, and sequestering agents, and step (b) is practiced by adding sufficient hydrosulfite bleaching chemical charge so that the hydrosulfite bleaching chemical comprises about 0.5-1.5 percent.

Fig. 1

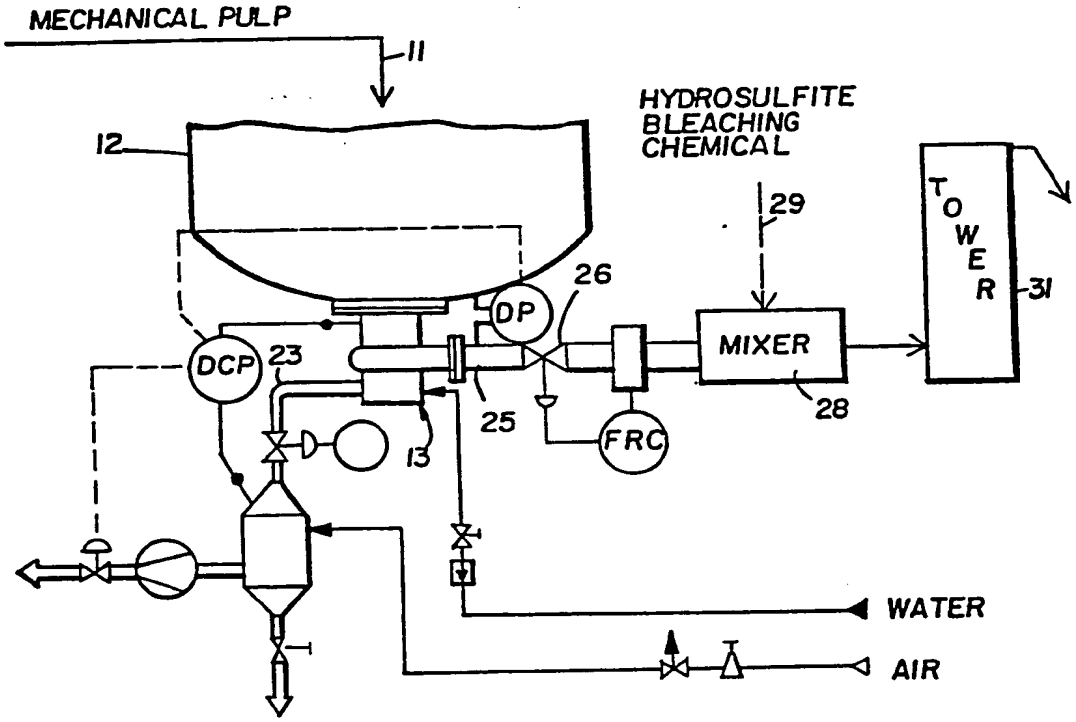
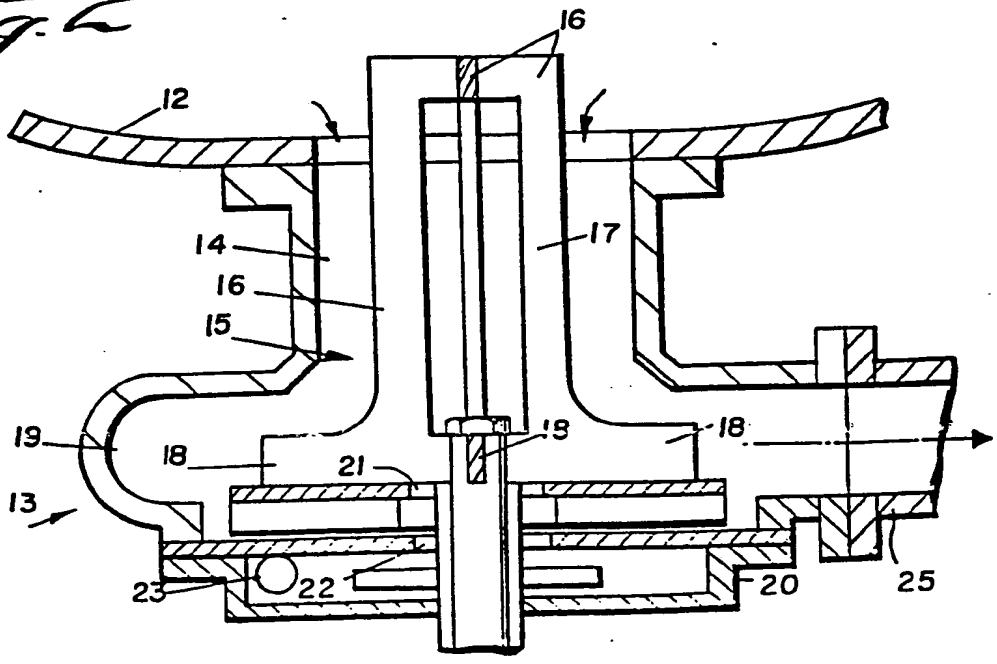

MECHANICAL PULP
11
12
HYDROSULFITE
BLEACHING
CHEMICAL
29
TOWER
31
26
DP
DCP
23
MIXER
28
25
FRC
13
WATER
AIR

Fig. 2


16
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25

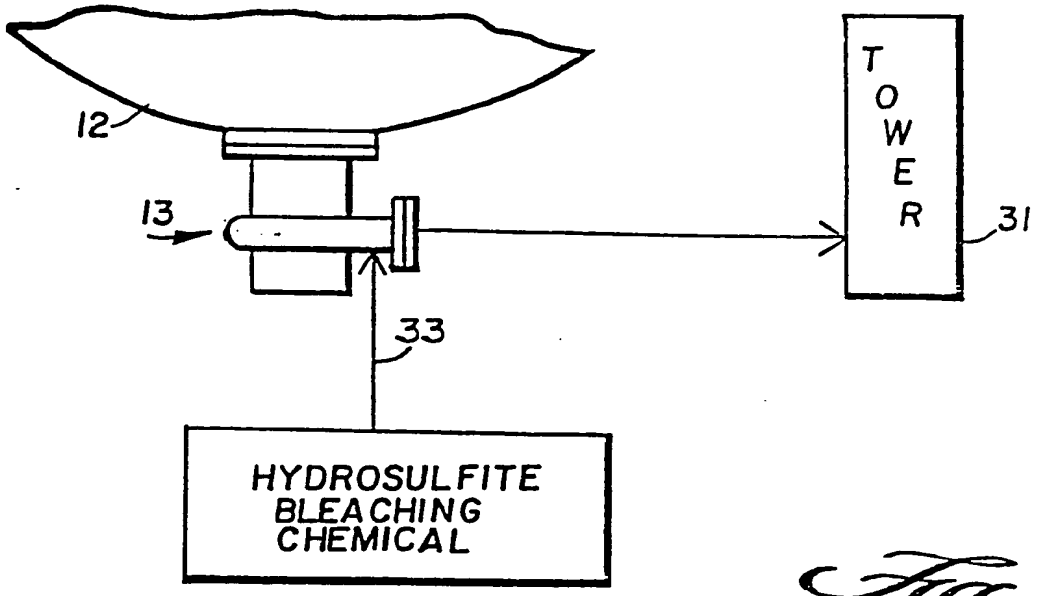
12
13
TOWER
31
33
HYDROSULFITE BLEACHING CHEMICAL

Fig. 3

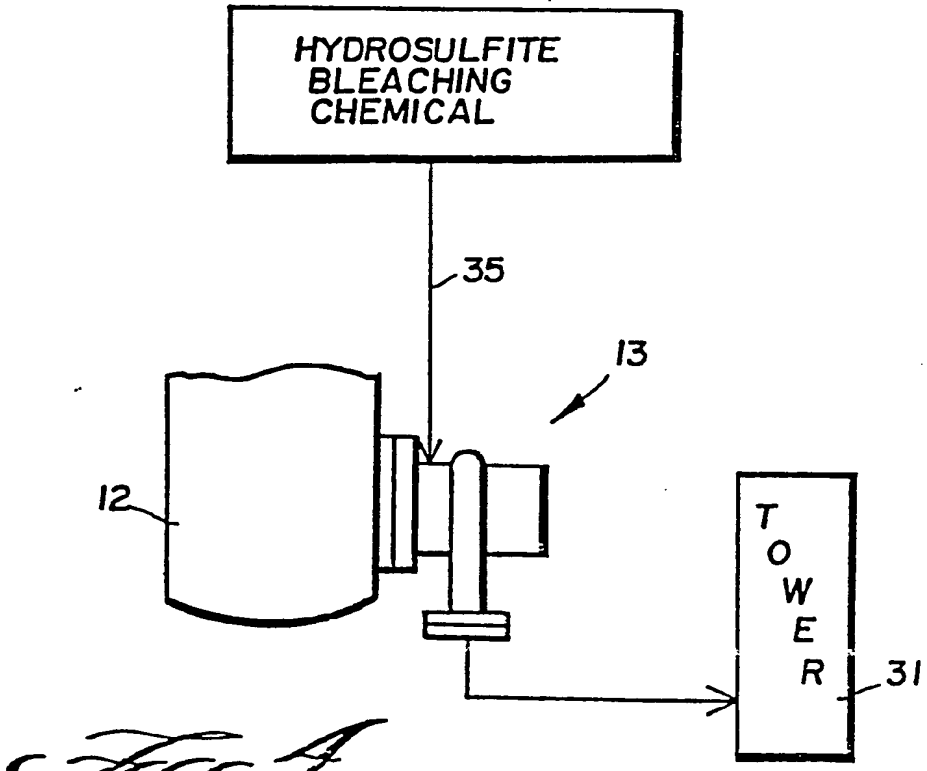
HYDROSULFITE BLEACHING CHEMICAL
35
13
12
TOWER
31

Fig. 4

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# EUROPEAN SEARCH REPORT

Application number
EP 85 89 0055

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int Cl 4) |
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| Y | TAPPI, vol. 64, no. 9, September 1981, pages 113-116, Atlanta, Georgia, US; J. GULLICHSEN et al.: "Medium-consistency technology II. Storage dischargers and centrifugal pumps" * Whole article, in particular, figures 7,10; page 115, last paragraph; page 116, first paragraph * | 1,4 | D 21 C 9/10 |
| Y | US-A-2 707 146 (T.M. BURTON) * Figure 1; column 1, line 15 - column 5, line 28; example * | 1-4,9, 10 | |
| A | | 6,8 | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |
| Y | US-A-2 963 395 (S. BACK et al.) * Whole document * | 1-3,9, 10 | D 21 C |
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-/-

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 31-05-1985 | NESTBY K. |

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## DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | US-A-2 071 307 (W. HIRSCHKIND) * Claim 1 * | 2,3,9 | |
| D,A | US-A-4 093 506 (J.C.F.C. RICHTER) * Whole document * | 5,6 | |
| A | US-A-3 313 678 (S.O. RYDIN) * Figure 2; column 4, last paragraph; column 5, first paragraph; claim 1 * | 1,4-6 | |
| | | | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 31-05-1985 | NESTBY K. |

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